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(21) International Application Number: PCT/EP95/05015 (22) International Filing Date: 18 December 1995 (18.12.95) (30) Priority Data: MI95A002105 13 October 1995 (13.10.95) IT (71) Applicant (for all designated States except US): PRIMA OFFICINA CARTE VALORI TURATI LOMBARDI E C. S.P.A. [IT/IT]; Viale Lombardia, 25, I-20056 Trezzo sull'Adda (IT). (72) Inventor; and (75) Inventor/Applicant (for US only): BOZZO, Ferdinando, Anto- nio [IT/AT]; Kendlerstrasse 76, A-5020 Salzburg (AT). (74) Agent: LECCE, Giovanni; Via Gaetano Negri, 10, I-20123 Milan (IT).		(81) Designated States: AM, AU, BB, BG, BR, BY, CA, CN, CZ, EE, FI, GE, HU, IS, JP, KG, KP, KR, KZ, LK, LR, LT, LV, MD, MG, MN, MX, NO, NZ, PL, RO, RU, SG, SI, SK, TJ, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: SYSTEM FOR THE SAFE AUTHENTICATION AND MANAGEMENT OF REGISTERED CREDIT INSTRUMENTS AND DOCUMENTS		
<p>The diagram illustrates a system for safe authentication and management of registered credit instruments and documents. It features a central processing unit (40) connected to a document (10) and a credit instrument (12). A finger (50) is shown interacting with a biometric sensor (46). The system also includes a security code (42) and a mathematical expression (44).</p>		
(57) Abstract System for the safe authentication and management of registered credit instruments or documents comprising: a personalized document (10) provided with a microprocessor to store an identification code CIP of the holder and information on biometric characteristics of the same; means for releasing said document (10) to the holder; means for issuing registered credit instruments (12) or documents; means for validating the credit instruments (12), all of said means being provided with a device for acquiring at least one biometric characteristic of the holder; said credit instruments (12) comprising at least a security code univocally generated by utilizing the personal identification code CIP as a cryptographic key; said information being associated to a mathematical expression of the data of the fingerprint of at least a finger of the holder of said document (10); the recognition for the issue of the credit instrument (12) and the validation being obtained by comparing the information got by direct reading of the finger of the holder and the application of the mathematical expression with the one stored in the document (10).		

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SYSTEM FOR THE SAFE AUTHENTICATION AND MANAGEMENT OF REGISTERED
CREDIT INSTRUMENTS AND DOCUMENTS

This invention relates to a system for the safe authentication and management of registered credit instruments and documents.

More particularly, this invention relates to a system suitable to identify with the utmost certainty the possessory title of a document which is univocally associated to the legitimate holder on the basis of a personalized card.

Besides, this invention relates to the apparatuses for issuing the personalized card and the document and for the validation of the latter, with the ascertainment of its authenticity on its utilization.

Concerning registered documents, special reference is made to a specific credit instrument utilizable for commercial transactions which are executed with the utmost security, as the possibility of an illicit use of said instrument by third parties - due to loss or stealing - is excluded.

Anyhow, the same system of authentication and management may be utilized for any other credit instruments, such as cheques, share certificates, certificates of indebtedness, savings books and the like, as well as personal documents or personal identification documents, of the kind, for instance, of credit cards, passports, identity cards and driving licences.

Several methods are known for the execution of the commercial transactions that involve the transfer of money between persons. Many transactions take place without any material transfer of currency, for instance through a bank which sees directly, upon request by the concerned person, to crediting the indicated person with a given sum.

In other cases, the payment is through credit instruments, for

instance bank cheques or bank drafts, relatively to which special cautions are adopted, to try to avoid their forgery or stealing and their illicit utilization.

Another form of payment is based on the use of credit cards, which authorize the holder to purchase goods or services with third parties having an arrangement with the issuer of said cards, to which the charge of the payment is transferred.

But also this form of payment is not free from risks, as the credit card may get lost or be stealed and unlawfully utilized, even though temporarily, by non authorized third parties.

The aforementioned payment forms, widely adopted, allow to limit the supply of cash, which however is still the more practical and direct and sometimes compulsory system to execute commercial transactions whose amount is not always small. Obviously the possession of cash gives rise to fairly serious security problems: in fact, stealed or lost currency can be easily used by anyone, generally without problems, as not even the guarantees exist that safeguard somehow or other the circulation of cheques and credit cards.

With an earlier patent application, the same applicant has intended to protect a system for commercial transactions suitable to obviate the aforementioned drawbacks, providing for the use of a personalized card integrating a microprocessor wherein a personal code and information are stored deriving from the application of a mathematical expression to the parameters referred to the fingerprint of at least a finger of the holder of the same card: based on such document, a credit instrument is issued, which can be associated only to the holder, and which may be, by way of example, a cheque for a given sum, validable with businesses that have stipulated an agreement with the

issuer, on the conclusion of the commercial transaction. Thanks to the provision of the personal code and especially the transcoding of the fingerprint integrated in the card, said credit instrument provides guarantees of utmost security, as it cannot be utilized by a person other than the holder, and also the person who receives the payment has the utmost guarantees, as there is the certainty of the authenticity of the the instrument, substantially assimilable to cash.

It has been stressed that this system is susceptible of modifications which can furtherly improve its already high level of global security, allowing at the same time to create simple apparatuses for the validation of the credit instrument or securities whose circulation is limited, by way of example, within the frame of this invention, to banks.

Object of this invention is therefore to provide a system for the authentication and management of registered credit instruments and documents, such as to provide the utmost security guarantees, causing them to be utilizable only by the holder to whom they have been legitimately issued.

A further object of this invention is to provide said credit instruments associated to the economic transaction or said registered documents or identity documents with a security print indissolubly associated to the paper support forming said instrument or document.

A further object of this invention is to realize simple apparatuses for carrying out the different stages of the system which allows to implement the above defined system.

These and still further objects are reached by the system for the safe authentication and management of registered credit instruments and documents subject matter of this invention,

comprising:

- a personalized document incorporating a microprocessor suitable to store a personal identification code of the holder and a numeric information associated to biometric characteristics of the same holder;
- first means for releasing said personalized document to the holder;
- second means for issuing registered credit instruments or documents; and
- third means to validate the use of the instruments or documents, all of said means being associated to an information system and provided with a device allowing to acquire at least a biometric characteristic of the holder;

said issued instruments and documents comprising at least a security code univocally generated by utilizing the personal identification code as a cryptographic key;

said information being associated to a mathematical expression of the data concerning the fingerprint of at least one live finger of the holder of said personalized instrument or document;

the recognition of the holder, both for the issue of the instrument or document and for the related validation, being obtained by comparing the information got through the direct reading of the live finger of the holder and the application of the mathematical expression with the information stored in the personalized documents.

The characteristics of the system for the safe authentication and management of registered credit instruments and documents subject matter of this invention will be better understood from the following description, wherein reference is made to the

attached drawings which show schematically a preferred non limitative embodiment of the same system, referred by way of example to a credit instrument, and wherein:

Fig. 1 shows the block diagram of the issue stage of the personalized card;

Fig. 2 shows the block diagram of the issue stage of the credit instrument, based on said personalized card;

Fig. 3 shows the block diagram of the validation stage of the credit instrument associated to the personalized card.

With reference to the aforementioned figures, the system for the safe authentication and management of registered credit instruments and documents subject matter of this invention comprises basically a personalized document 10 and a paper support forming the credit instrument 12. The personalized document or smart-card 10, formed, by way of example, by a card having dimensions similar to those of the conventional credit cards, incorporates a microprocessor wherein there are stored a personal identification code CIP and a mathematical expression associated to at least one fingerprint of the person who requires of the issuing institution, for instance a bank, said card 10, to utilize the system subject matter of this invention referred to a credit instrument to perform commercial transactions. The personal identification code CIP, for instance in the form of an alphanumeric sequence univocally associated to each holder, is generated by the information system of the issuer SI and sent to the apparatus for the personalization of card 10, of which more will be said in the following. The mathematical expression stored in the microprocessor of card 10 is advantageously formed by an algorithm of the DES type (Data Encryption Standard), which allows to transcode the parameters associated to the fingerprint

of one or more fingers of the applicant, forming therefore a unique feature of the same.

In the microprocessor of card 10 there are also stored, according to a preferred non critical embodiment, particulars and tax number of the applicant, as well as the current account number, complete with the bank co-ordinates, for the domiciliation of the credit instruments to be issued and negotiated.

The credit instrument 12, which is the means for the execution of the economic transaction through the system subject matter of this invention, is formed by a support, preferably from paper, whose scheme is shown in Figs. 2 and 3, shaded, by way of example, like bank cheques or drafts: anyhow, said support may also be of different size, as the system of this invention concerns in general all of the credit instruments, as for instance savings books, share and deposit certificates, besides the mentioned personal documents or personal identification documents. According to a preferred embodiment, said support has the configuration of a conventional cheque, for instance from watermarked paper, which is authenticated on the basis of the data previously stored in the microprocessor of card 10. In particular, through an apparatus of which more will be said in the following, a dot coding (not interpretable at sight) is provided, along a prefixed field, on the paper support forming the credit instrument 12, which coding defines, for instance, the issuing date, the code of the issuing institution and the amount of said instrument. The same data are also formed along a distinct field, expressed in cryptographic form through a key made up by the aforementioned personal identification code stored in card 10.

According to a further characteristic of the invention, the

support forming the credit instrument or security 12 is provided with a security print 14, of any shape and size, made up by two or more zones with different light reflection: said zones are formed by an alternation of embossed and hollow sectors, circumscribed by approached lines differently oriented by groups relatively to one another. Impression 14 as a whole is obtained in reflecting or metallic ink, through offset and dry copperplate printing processes. The characteristics of the mentioned security print with which the support forming the credit instrument 12 is advantageously provided are not described in detail, being the subject matter of an autonomous patent application registered in Italy by the same applicant.

For the implementation of the system of this invention, by way of example and not critically referred to a credit instrument to carry out commercial transactions, specific apparatuses are supplied, some of which have already been mentioned: there are, in particular, a first apparatus allowing to issue the personalized document, in the following referred to as card, and a second apparatus which, against the recognition of the applicant through the parameters stored in the microprocessor of said card, allows to issue the credit instrument and to authenticate it univocally. A third apparatus, described in detail later on, validates the instrument on its utilization, by means of a triangulation.

The first apparatus, shown as a scheme in Fig. 1, allows to realize the starting stage of the system of this invention, issuing the document or personalized card 10. Said apparatus comprises a personal computer 16, connected to the information system SI of the issuing institution, for instance a bank, through a communication line 18; the information system SI

checks, through the connection with the anagraphical file and current accounts file of the institution or body issuing card 10, the existence of the corresponding data (particulars and proprietary title of the applicant) relative to the person requiring said card. The apparatus comprises also a reader/encoder 20 of card 10 to be personalized, an a biometric identity sensor 22. The reader/encoder 20, connected to the personal computer 16 and consequently to the information system S1 through line 18, receives from the latter the personal identification code CIP; the biometric sensor 22, connected to or integrated in the reader-encoder 20, senses and transcodes the print or fingerprints of the applicant, who puts the finger or fingers in sequence on a special seat 24 obtained on the same sensor 22. The latter is obviously provided with one or more openings (not shown) for the introduction and coming out of card 10 to be personalized.

The apparatus schematically shown in Fig. 2, which realizes the second stage of the system subject matter of this invention issuing the credit instrument 12 based on the data of card 10, is substantially formed by the same components as the preceding apparatus, with the addition of a printer. In detail, said apparatus comprises a personal computer 26 connected to the information system SI of the issuing institution through a communication line 28 and a software programme SW3, a reader 30 of the personalized smart-card 10, an identity reader or biometric sensor 32 having a seat 34 where the applicant puts the finger or fingers, and a printer 36, preferably an ink jet printer with graphic printing modalities. Said printer prints in cryptographed form, on the paper support forming the credit instrument 12 which is inserted in it, a security code formed on

the basis of the data existing on card 10, authenticating said instrument. Printer 36 is provided with a conventional opening(s) (not shown) for the introduction and coming out of the credit instrument 12 to be authenticated.

For the implementation of the system subject matter of this invention a third apparatus is provided, schematically shown in Fig. 3, analogous to the preceding one and provided with further functions, being utilized in the last stage on the utilization and validation of the credit instrument 12. Said apparatus comprises a personal computer 40 connected to the information system SI of the issuing institution through a communication line 42 and a software programme SWC, a reader 44 of smart-card 10, a biometric identity sensor with a seat 50 where the applicant put the finger or fingers, and a printer 48. The latter is provided with a device which provides to the possible invalidation of the negotiated instrument 12.

The biometric sensor, comprised in all the above described apparatuses, is substantially made up by a terminal controlled by an built-in microprocessor specialized for the check of the identity based on the biometrical data of the fingers and the technology of the card. Both the built-in application and the data reside in an internal RAM permanently fed by a lithium battery; the security is ensured by a built-in microprocessor and by a built-in tamper proof security microprocessor, with secret keys, independent and unalterable, for the DES cryptography, permanently fed by the lithium battery.

The system for the safe authentication and management of registered credit instruments and documents subject matter of this invention is articulated, as concerns the development of the operations, according to the following modalities.

Distinction is made, as specified above, between three different operating stages:

- issuing of the personalized smart-card 10;
- issuing of the instrument or security 12 with security apposition;
- treatment of instrument 12 with authentication of the holder.

The first stage is associated with the issue of card 10, which has preferably a temporary validity; through the apparatus schematically shown in Fig. 1, card 10 to be personalized is introduced, through a special slit (not shown), in the reader/encoder 20. Now, the connection is made with the information system SI of the issuing institution through the communication line 18, to record the issuing operation of card 10 and to receive from the same system the personal identification code CIP of the client. Said code is stored in the microprocessor of card 10 by the reader-encoder 20 in a protected manner, preferably in the form of an alphanumerical sequence. At the same time, the applicant puts the finger on seat 24 of the biometric sensor 22; the print, or possibly several prints, corresponding to as many fingers, are stored in the microprocessor of card 10 in transcoded and protected form with the personal identification code CIP. During this stage, performed by the biometric sensor 22, further indications are preferably stored in card 10, such as, for instance, the expiry date of the same card and the particulars of the client or other data.

Following this operation, card 10 is univocally personalized and allows to start the second stage which, through the apparatus schematically shown in Fig. 2, causes the issuing of the credit instrument or document 12, introduced in printer 36. The mentioned security print 14 in metallic or reflecting ink is already

present on the paper support forming said instrument. During this issuing stage, through printer 36 a security code is printed, for instance of the known type PDF 417, subdivided into two parts that are not interpretable at sight: the first part of said code includes all the data relating to the release of the instrument (for instance, data and place of issue, institution and branch, document number, etc.), while the second part of the code comprises the same data as the first one, expressed in cryptographed form by means of the key formed by the personal identification code CIP, which can be univocally associated as such to the person requiring the credit instrument 12. The applicant puts the finger in correspondence of seat 34 of the biometric sensor 32 for the validation of his own print against the one stored in protected form in card 10 and sensed by reader 30. Reader 30 autonomously provides to reading the data of card 10 through the mathematical expression or algorithm and the personal identification code CIP of the applicant: such code is therefore utilized as a cryptographic key to generate the security code which printer 36 prints on the paper support forming the credit instrument or security or document 12. Also in this case, the details of the transaction are recorded through the communication line 20 in the information system SI of the issuing institution.

Now the applicant has a univocally personalized credit instrument 12, which he can use in case of need giving his card, also personalized, to the personnel who performs the treatment and authentication of the same instrument through the third apparatus schematically shown in Fig. 3.

Supposing that the system subject matter of this invention be limited to the credit institutions where the two first apparatus-

ses are installed, also the third apparatus will be installed in the same institutions or with a branch. The owner of the personalized instrument 12 introduces preliminarily in reader 44 of said apparatus his card 10 and at the same time or immediately after, puts his finger on seat 50 of the biometric sensor 46, for the validation of his print against the one stored in protected form in the microprocessor of the same card. In case of positive recognition, reader 44 reads on card 10 the personal identification code CIP of the owner of instrument 12, which is adopted as a key to check the consistency between the two parts of the security code, utilizing the same mathematical expression of cryptography used on the issue of said instrument. The positive recognition, based on the univocal aspect of the fingerprint with the contextual activation of the other two elements, confirms the validity of document 12, excluding any illicit utilization of the same. Now printer 49 can provide to the invalidation of instrument 12, while the personnel of the branch assigns the sum of money corresponding to the value of said instrument or validates the authentication of the person. The invalidation stage of the credit instrument is made by printing on the paper support forming the same instrument a writing, for instance "negotiated" or "paid" through said printer 49. Through the communication line 42, connected to the information system SI, also this ending stage of the transaction is recorded.

One should anticipate that the operations concerning the issue stage of card 10 with the intervention of the first apparatus may comprise also the issue of a further card for a co-holder whose particulars are obtained with the same modalities described above. One should also anticipate that the same apparatus issuing the card may provide also to the renewal of the same,

with the updating of the particulars on the client and/or the issue of a new personalized document.

As can be understood from the above, the system for the authentication and management of registered credit instruments and documents subject matter of this invention provides guarantees of utmost security; in fact, the issued instruments can be exacted only by the legitimate holder based on a precise and univocal check.

The advantages of said system, which, as described above, may be adopted to prevent the risk connected to the circulation of any registered credit instrument or document, are especially evident if said instrument attributes the holder the ready availability of a given amount of money; in fact, the same holder can readily cash the corresponding sum with any body having entered an agreement with the issuer, disposing therefore of cash in hand, without running any risk.

Even in the unlikely hypothesis of a contemporaneous loss or stealing of the personalized credit instrument and the card, the money cannot be cashed by third parties as on the check made before paying, there would be no correspondence between the fingerprint of the holder and the one stored in the card micro-processor.

Anyhow, the invention, as described hereabove and claimed hereafter, has been proposed by way of example, being obvious that the same may be susceptible of many changes and variants, all of them falling however within the invention concept.

For instance, the apparatus for the issue of the registered credit instrument or document and the apparatus for the related validation, and possibly also the first apparatus providing to issuing the personalized card, might be incorporated in only

apparatus; in the same way, the card reader and the biometric sensor comprised in the second and the third apparatus might be incorporated in one only station.

Lastly, while the system has been proposed by way of example for a realization within the bank circuit, further possibilities are not to be excluded in this regard: in fact, the basic need of having several places available for the fruition of the system may be satisfied by different bodies, for instance Post Offices, Communes or local administrations in general.

CLAIMS

1. A system for the safe authentication and management of registered credit instruments and documents, comprising:

- a personalized document (10) incorporating a microprocessor suitable to store a personal identification code CIP of the holder and a numeric information associated to biometric characteristics of the same holder;
- first means for issuing said personalized document (10) to the holder;
- second means for issuing registered credit instruments (12) or documents; and
- third means for validating the use of the registered instruments (12) or documents, all of said means being either associated or not associated to an information system SI and provided with a device for acquiring at least one biometric characteristic of the holder;

said registered instruments (12) or documents issued comprising at least a security code univocally generated utilizing the personal identification code CIP as a cryptographic key;

said information being associated to a mathematical expression or algorithm of the data related to the fingerprint of at least a live finger of the holder of said personalized document (10); the recognition of the holder, both for the issue of the registered instrument or document and for the related validation, being obtained by comparing the information got through the direct reading of the finger of the holder and the application of the mathematical expression with the one stored in the personalized document (10).

2. The system according to claim 1, characterized in that said mathematical expression is formed by an algorithm of the DES

type.

3. The system according to claims 1 and 2, characterized in that said means for the release of the personalized document (10) comprise a personal computer (16) connected to a reader/encoder (20) for storing in protected form in the microprocessor of the document (10) said personal identification code CIP of the holder supplied by the information system SI of the issuing institution through a communication line (18), and a biometric sensor (22) for storing in transcoded form in the same microprocessor, to form said numeric information or algorithm, at least a fingerprint of the holder, who puts the finger in correspondence of a seat (24) of said sensor.

4. The system according to claims 1 and 2, characterized in that said means for issuing credit instruments or documents (12) comprise a personal computer (26) connected to the information system of the issuing institution through a communication line (28), a reader (30) of the personalized document (10), a biometric sensor (32) and a printer (36) provided with graphic modality for printing on said credit instruments (12) a security code not interpretable at sight, generated by said personal identification code CIP, utilized as a cryptographic key and sensed by sensor (32) in case of positive recognition following the comparison between the fingerprint of the holder, who puts the live finger on a seat (34) of said sensor, and the one stored in protected form, forming the numeric information, in the microprocessor of the document (10).

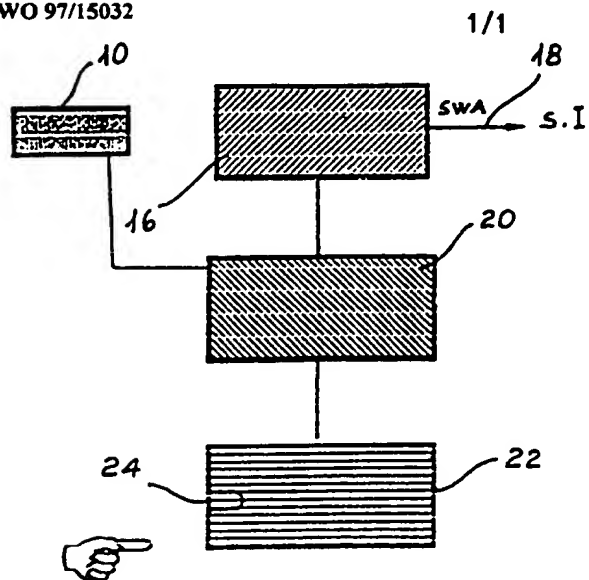
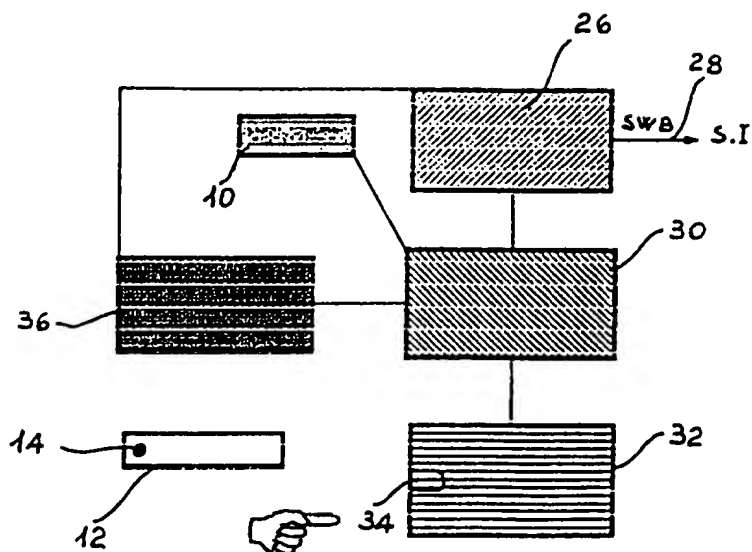
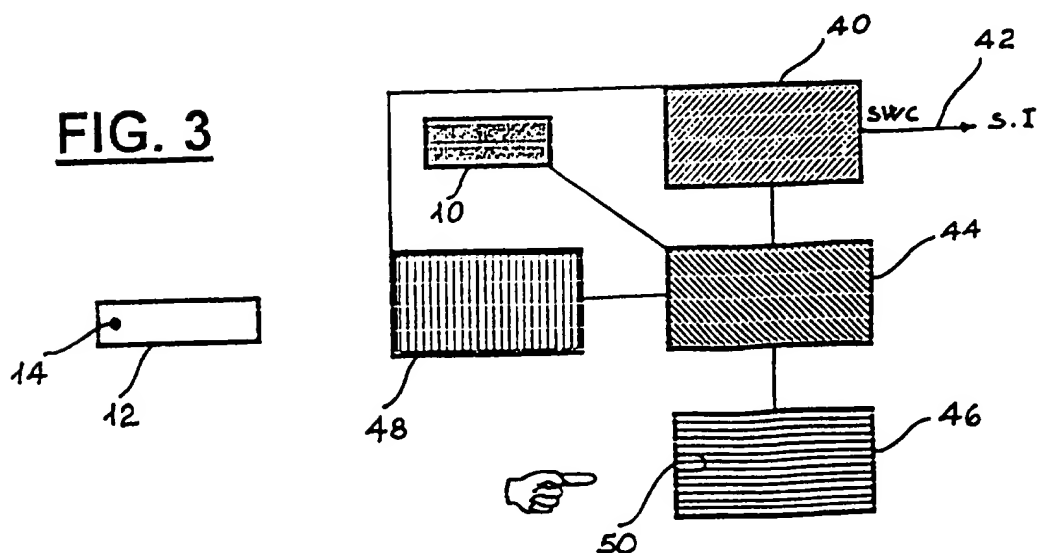
5. The system according to one or more of the preceding claims, characterized in that said means for validating the use of the credit instruments or documents (12) comprise a personal computer (40) connected to the information system SI of the issuing

institution through a communication line (42), a reader of the personalized document (10), a biometric sensor (46) and a printer (48) provided with graphic modality for invalidating said credit instruments (12) in case of positive recognition following the comparison between the print of the holder, who puts the live finger on a seat (50) of the same sensor, and the one stored in protected form, forming the numeric information, in the microprocessor of the document (10).

6. The system according to one or more of the preceding claims, characterized in that said credit instruments or documents (12) are made up by a paper support on which there is obtained a security print (14) in reflecting or metallic ink, having two or more zones with different light reflection, said zones being formed by alternating embossed or hollow sectors, circumscribed by approached lines differently oriented by groups relatively to one another.

7. The system according to one or more of the preceding claims, characterized in that said means for the release of the personalized document (10), the issue of registered credit instruments or documents (12) and the validation to the use of the same registered instruments or documents are independent on or integrated in one or more apparatuses.

8. The system according to one or more of the preceding claims, characterized in that said means for the release of the personalized document (10), the issue of registered credit instruments or documents (12) and the validation of the same registered credit instruments or documents are combined with one another depending on the card (10), the same registered credit instruments or documents (12) and/or the related paper support.

**FIG. 1****FIG. 2****FIG. 3**

INTERNATIONAL SEARCH REPORT

International Application No

PC 1/EP 95/05015

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G07F7/08 G07C9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G07F G07C G07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 96 05576 A (PRIMA OFFICINA CARTE VALORI TU ;BOZZO FERDINANDO (AT)) 22 February 1996 cited in the application see the whole document ---	1-8
A	EP 0 097 110 A (BONNAVAL LAMOTHE MICHEL ;GRAFEILLE JEAN MARIE (FR)) 28 December 1983 see abstract; claims 1-11; figures 1-9 see page 3, line 17 - page 4, line 25 see page 7, line 17 - page 8, line 2 see page 12, line 10 - page 13, line 13 ---	1,4,5,7, 8
A	FR 2 581 776 A (BERTIN & CIE) 14 November 1986 see the whole document ---	1-5,7,8
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 157 726 A (MERKLE RALPH C ET AL) 20 October 1992 see abstract; claims 1-18; figures 2,3 ---	1,3-5,7, 8
A	GB 2 256 170 A (BRANDES WILLIAM ROBERT) 2 December 1992 see abstract; claims 1-5; figure 1 ---	1,3-5
A	EP 0 590 224 A (RUSSI FRANCO) 6 April 1994 see column 1, line 39 - column 6, line 7; claims 1-11; figures 1-5 ---	1-5,7,8
A	GB 1 369 537 A (OSTERTAG WERKE AG) 9 October 1974 see page 2, line 17 - page 3, line 78 see page 4, line 112 - page 5, line 24; claims; figures 1,2 -----	1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

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